SQUINT SURGERY IN THE YOUNG

by

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CHAPTER I

HISTORY OF SQUINT

Among the first to mention squint was Hippocrates 460-370 B.C. Hippocrates noted the two varieties of squint, the paralytic and comitant. Galen in 131-210 A.D. gave a fairly good description of the ocular muscles.

Fallopuis in the sixteenth century gave us our first accurate description of the extra ocular muscles. Palus Argineta and later Ambroise Pare, speak of squint and a method of correction by a mask with pin hole apertures. Antoine Maitre, Jan. 1707, stated that some authors claimed malposition of the crystalline lens caused squint, others that it was due to imaginary vices of visual spirits. Some claimed that it was due to contraction or spasm of the ocular muscles, and in the same discourse it is mentioned that objects look larger to patients who squint.

In 1727, appeared the bombaster, John Taylor, an itinerant oculist of Norwich, England, who went about curing squint by cutting the conjunctiva at the inner canthus and occluding the good eye to cause the use of the squinting one. There is evidence that he did put eyes straight by operating, but what he really did will always remain a mystery.

An event of historical importance in the treatment of squint was the recommendation of Buffon, 1743, to cover the good eye and force the use of the squinting one, and thus improve its vision and aid in the cure of squint. He also recommended the use of glasses in certain conditions; thus he might be said to have been the first to inaugurate the

two most beneficial and most frequently used non-surgical aids in the treatment of squint. Erasmus Drawin indorsed the idea of Buffon, that defective vision caused the eye to squint. Tenon, in 1806, gave that most comprehensive anatomy of the orbit, and in particular the description of the capsule which bears his name, and this information without doubt has had much to do with subsequent treatment of squint.

In the first third of the nineteenth century came the first definite effort to treat squint surgically. Delpech's operation of dividing the tendon of Achilles, in 1816, might be called the forerunner of tenotomy. In 1827 Anthony White suggested the cure of squint by means of tenotomy. Poulu, of Landeau, was probably the first to attempt a tenotomy of the internal rectus on the living, as recommended by Anthony White. This, however, was not a success. The first authentic tenotomy for relief of squint was performed by Dieffenbach in 1839. Later Dieffenbach attempted to increase results by a myotomy. The results were not good due to over-correction that took place.

About the same time A. von Graefe adopted a more conservative procedure, which consisted of a tenotomy done close to the sclera, followed by a conjunctival stitch; much as it is done today. In 1842 Dieffenbach did an advancement to correct one of his over-corrected myotomy operations, but this was not a success.

Guerin, in 1849, gave a practical procedure of advancement but the more accurate description of an advancement operation was by A. von Graefe in 1857. This was the famous Faden operation. The same year G.

Critchette of London described his three stitch operation, of which Beard has said, might be "called the parent of the most modern advancement operations". In 1897, Landolt made some improvements on Critchett's advancement and this operation is extensively practiced at the present time. Almost every advancement operation since has been more or less a modification of Critchett's or Landolt's.

CHAPTER II

ETIOLOGY OF SQUINT

Many theories have been advanced to explain the presence of squint. Among the first theories of importance was the muscular theory. Later Donders promulgated the accomodation theory. Perhaps the two theories holding most importance today are those offered by Daune and Worth.

Daune believed that esotropia usually develops out of a simple convergence-excess to which is added divergence insufficiency, and an exotropia develops out of a simple convergence-insufficiency to which is added a divergence-excess. The changes that take place, according to Daune, are undoubtedly central. In esotropia excessive stimulation of the center for convergent movement produces and inhibition of the center for the opposing movement. In exotropia there is an excessive stimulation of the center for divergent movement and a subsequent inhibition of the center for convergent movement. The final result is that in esotropia we have added to the convergence excess a progressive divergence insufficiency and the vice-versa is true in exotropia.

Worth and many others believe that a defect of the fusion faculty is an important factor in producing squint. The fusion faculty begins to develop early in life and is complete before the end of the sixth year; this establishes a desire for binocular vision which keeps the eyes straight. "Sometimes, however, owing to a congenital defect, the fusion faculty develops later than it should, or it develops imperfectly, or it may never develop at all. Then there is nothing but the

motor coordinations to preserve the normal relative directions of the eyes, and anything which disturbs the balance of these coordinations will cause a permanent squint".

In addition there are a number of factors through which the provocation for the development of squint may be supplied. Briefly, these factors may be given as follows:

1. Hypermetropia
2. Anisometropia
3. Hyperphona
4. Esophoria and exophoria in the absence of the controlling influence of the fusion sense.
5. Specific fevers such as whooping cough.
6. Violent mental disturbance as convulsions.
7. Hereditary influence. Worth found history of squint in parent, grandparent, brother or sister, in 51.78% of his cases.

CHAPTER III

NON-OPERATIVE TREATMENT OF SQUINT

The treatment of squint (strabismus) in the young child as practiced by the average ophthalmologist at the present time has not materially advanced from that recommended by Javal one third century ago. Javal corrected the error of refraction with glasses, used atropine in the good eye, excluded entirely for a time the good eye in selected cases to develop the vision in the deviating eye, used the stereoscope to bring about fusion where this was possible without operation, and in cases in which deviation was too great recommended early operation to set the eyes sufficiently straight to use the stereoscope. With reference to operating he says: "It is a mistake to believe that operation gives better results at a more advanced age. The sooner it is done that greater are the chances that it will suffice".

With this introduction let us proceed. There are certain objects to be kept constantly in mind in the treatment of squint as given by Worth, namely:

1. To prevent deterioration of the vision of the deviating eye, and to restore, as far as possible, the sight of this eye in cases in which amblyopia from disuse has been allowed to occur.
2. To endeavor to remove the fundamental cause of squint, by training the fusion sense at the earliest possible age.

3. To restore the visual axis to their normal relative direction.

To accomplish these objects the following therapeutic measures are available:

1. Optical correction of any refractive error.
2. Occlusion of the fixing eye.
3. Instillation of atropine into the fixing eye only.
4. Training the fusion sense
5. Operation.

The first four of these steps will be considered under non-operative treatment while the surgical procedures will be discussed in another chapter.

Optical Correction.

The child's refraction should be most carefully determined by means of retinoscopy done after he has been under atropine for at least seven to ten days. Accuracy is important here since the wrong glass at this delicate age may be the one thing that turns the tide the wrong way. Glasses should then be ordered which will correct within 0.50 D. of the full hyperopia and all of the astigmatism. Where the lenses obscure the vision markedly it is at times advisable to order the first lenses somewhat weaker and change them to stronger ones after one month's use. In cases of myopia and myopic astigmatism best results are obtained by exact correction.

The glasses should be worn constantly except when the child is

in bed at night. They should never be removed at any other time except for cleaning purposes.

No infant is too young to wear glasses if they are required. Worth describes many cases in which he has prescribed glasses before twelve months of age, and some before six months.

Occlusion of the Fixing Eye.

The most rapid and effective way of reestablishing central fixation where it is lost, is by absolute occlusion of the good eye to thus force the use of the weaker one. This is best done by placing over the good eye a very snug eye-pad with bandage. Children who are well cared for may have the pad changed every second or third day. It may, if desired, be left undisturbed for a week at a time without any harm resulting. This should be kept up until four to six weeks have elapsed.. If occlusion of the fixing eye is going to do any good, usually definite improvement of vision in the squinting eye will have been noticed by this time. If no improvement of vision in the squinting eye is noticeable, and the power of central fixation has not been secured, it is of little benefit to continue longer, though further persistence is sometimes rewarded with success.

Instillation of Atropine into the Fixing Eye Only.

Atropine is indicated in all cases of squint to paralyze the accomodation to determine the error of refraction. In the treatment of squint it is indicated to paralyze the accomodation in the fixing eye and force the use of the previously squinting one. If atropine causes

the vision in the straight eye to be less acute than that in the deviating eye, the latter will at once straighten and will be the eye used. This use of the deviating eye will usually bring about the desired acuteness of vision. If normal vision could be secured in the deviating eye, there would usually be very little difficulty in securing tinocular vision and thus we would be able to cure our case without operating. The use of atropine for the fixing eye only is an exceedingly efficient curative measure. A child spends one-third of his waking hours in looking at near objects, so that when he uses the atropised "fixing eye" in distant vision and the unatropised "squinting eye" in near vision, this is equivalent to perfect occlusion of the fixing eye for several hours each day. When his glasses are taken off for any purpose, if he has much refractive error, he turns in the atropised eye even in distant vision.

This treatment will always prevent the deviating eye from becoming amblyopic. Its efficiency in curing amblyopia which has already been acquired will be greater the younger the child and the more recent the deviation. After about seven years of age usually not much improvement of vision can be obtained. As to the amount and strength of atropine used Wilkinson finds a drop of one-half per cent solution used in the straight eye night and morning is most successful. Worth, however, uses one drop of one per cent atropine sulphate in good eye every morning. Worth warns against prolonged use of atropine in both eyes and considers it one of the best ways of producing permanent squint as it is his opinion that it tends to cause a more complete suppression

of the image of the already squinting eye.

Training the Fusion Sense.

No set of eyes can be put straight and kept straight without binocular vision or fusion. This faculty, innate in man, is the one essential in curing squint, hence the importance of determing its presence, its degree and adopting methods to increase its amplitude in each case. Worth has given us three grades of binocular vision, as follows:

1. Simultaneous, Macular perception; that is, the ability to recognize objects perceived by each macula. In these cases there is no particular desire for binocular vision. In other words, the fusion power is of the lowest grade, and any contributing cause may upset the binocular vision and cause squint.

2. Second Grade, comprises those who have fusion with some amplitude. In these cases there is a definite desire for binocular vision and when similar objects are placed in the stereoscope or the amblyoscope these objects are fused into one image when approximated, and this one image is maintained even when the stereoscope or amblyoscope is separated several degrees. This shows that there is a definite effort on the part of the patient to fuse these images. In these cases the phoria is overcome in the interest of binocular vision.

3. The third grade Worth calls the "sense of perspective". Each eye sees an object at a different viewpoint from the other eye.

In other words, an object seen by the right eye is seen farther around to the right than the same object is seen by the left eye, and vice versa, but these images are so blended that we are aware of but one mental impression. This sense of perspective enables us to determine depth and fullness of objects and cannot be obtained with the use of one eye only. If we now add perfect acuity of vision, we shall have such a strong and perfect binocular vision that no amount of refractive defect or overacting muscles can cause squint. In fast, as Worth has aptly said, "Nothing but a paralysis of the ocular muscles could cause squint, and this would produce an intolerable diplopia".

Fusion training is carried out by some form of the stereoscope. Worth has devised what is called the amblyoscope with which he has been very successful. The chief function of the stereoscope is the blending of the two images of an object taken from slightly different angles, and thus giving to the objects the appearance of solidity. Worth has arranged a very attractive set of object slides to be used in his instrument. These are designed to be used according to the degree of fusion present as follows:

1. Those which do not require any blending of images, i.e. those in which there is only simultaneous vision- his first grade of fusion.

2. Those requiring true fusion of images in order that a complete picture can be seen. This is his second grade of fusion. These pictures are similar except for cer-

tain omissions in each slide, so that it requires both images to make a complete picture.

3. Those which are intended to bring out the third grade of fusion or a sense of perspective.

The favorable time for fusion training is between the ages of three to five years. Under three years of age the treatment is apt to be difficult, after five years the fusion training takes longer and a much less powerful desire for binocular vision is obtained. To attempt fusion training after the sixth or seventh year is seldom worth while. Neither is fusion training of any avail if the deviating eye is too blind. But if the child is young enough and his deviating eye is not blind, a fairly strong desire for fusion can be created in five or six lessons given at weekly intervals. When the training can be efficiently carried out at home, the child should have a lesson of a few minutes duration every morning. As the fusion sense develops different sets of slides will be used according to the grade of fusion possessed by the individual.

CHAPTER IV

THE SURGICAL TREATMENT OF SQUINT

The important points in the development of squint surgery have already been given. The various types of squint surgery will now be presented. Wilkinson has listed squint surgery in the following manner:

1. Tenotomy, complete and partial
2. Advancement
3. Resection
4. Tucking
5. Recession.

Complete tenotomy is an operation which involves cutting the tendon of an ocular muscle at its insertion into the globe. Myotomy consists in cutting the muscle farther back through its muscular fibers. Cutting the muscle tendon at one or more places so that the muscle is only partially detached from the globe is called partial tenotomy. Tenotomy of the internal rectus is permissable on grown subjects with morbid deviations and morbid amblyopia where there is serious objection to any operative procedure on the good eye. Because it is impossible to predetermine the result of a tenotomy and because tenotomy of the internal rectus interferes with convergence, it is never justifiable where there is hope of securing binocular vision. Partial tenotomies have a larger field of usefulness than complete tenotomy. In the hands of skilled surgeons more accurate and efficacious results can be obtained with partial tenotomies than with complete tenotomies.

By an advancement operation is meant the bringing forward of

the tendon of the ocular muscle and attaching it to the globe nearer the cornea, thus giving it greater power over the movements of the eye. Concerning advancement operations, Wilkinson mades the following statement: "The author has not found the immediate effect of any advancement by any method to be the permanent effect when advancement alone is done. If some means is not used to prevent the constant drawing of the internal rectus on the sutures placed in the advancement of the external rectus in cases of comitant convergent squint, the immediate effect will always be greater than the final effect. This does not necessarily obtain where a tenotomy, recession, or even a partial tenotomy has been done". It is important in doing an advancement operation to bear the above facts in mind. The advancement operation is the operation of choice in slight degrees of internal rotation in young subjects. In this case an advancement of the external rectus of the deviating eye may be done. In deviations above twenty degrees, it is usually advisable to advance both external recti muscles in prominent eyes or to do a recession and advancement operation on the same eye.

An operation in which the muscle is shortened and attached to or near its original attachment is called a resection operation. In a connection with this operation instruments have been devised by which the actual amount of shortening that is being done can be measured. Also scales have been devised to determine the pull or resistance of the muscle. Now, with these two instruments fairly accurate results can be obtained and consequently this is a much used operation.

There are two types of folding or tucking operations. In one

the shortening is made by the use of a suture alone. In the other, the tendon is folded over an instrument and sutured in place. These operations are indicated in those cases in which there has been left only a slight degree of defect. With reference to this form of operation Wilkinson states: "The objections to these methods are - first there is always a great doubt as to the amount of correction that will be secured. In the second place, the folding operation, when the thread alone is used, usually corrects only a very small amount of the defect When tuckers are used, more effect can be secured, but it is difficult to measure accurately the amount of shortening that has been done. In addition to this, there is usually an ugly lump caused by the tendinous fold, which remains for a long time.

Recession operation, or setting back of the muscle toward which the eye deviates is indicated when the muscle is abnormally short. This condition in which the muscle is abnormally short is found in certain cases of congenital squint and in a few cases of acquiredsquint in the middle aged or elderly subjects who have had the defect for a great many years. One of the best recession operations was introduced by Dr. Jameson. It gives definite and accurate results. The only real objection is the amount of scarring produced. Modification of Dr. Jameson's operation eliminates this undesirable feature.

Indications for Surgery.

There has been in the past and there still exists considerable variance of opinion as to just when and on whom squint surgery is indi-

cated. With reference to this subject Wilkinson gives the following excellent discussion in which he includes a statement by Dr. Volk.

"It is my practice to operate as early as it can be determined that orthoptic treatment, together with glasses and atropine, is not going to correct the defect. This can certainly be determined in six months in the average case, and much sooner in most cases. If, after the use of glasses, atropine when indicated, use of pads to bring up lost visual acuity, and orthoptic exercises, the degree of squint is not lessened, it is our duty to put the eyes as nearly straight as possible and begin again our orthoptic training. This must be done early to secure the aid of fusion, as fusion training is of little avail later. The more I treat crossed eyes and the greater amount of experience I have, the more inclined I am to accept the teachings of the late, Dr. Volk, who was of the opinion that practically all these cases are operative cases. He said: 'It has been my observation that practically all these cases of so-called cured squint still have more or less esophoria, and many would be relieved of the necessity of the constant use of glasses if they were relieved of the muscular unbalance by judicious operation'. There is no doubt but the use of the stereoscope to perfect binocular vision is more successful after operating in those cases with a decided defect. In fact more can be done toward a permanent cure in a few minutes in the operating room than can be accomplished in weeks and even months of training with the stereoscope. If these eyes are set approximately parallel (and this can be done by means of proper study and measurement beforehand)the innate desire for fusinn and the natural objection to diplopia will cause even the youngest child

to acquire naturally binocular vision. This is the very reason we advocate early operative interference. If these children are permitted to become more or less ambyopic in one eye, the image from that eye is not so perfect as that from the good eye, and the tendency for fusion of the two images is not nearly so great. The earlier we operate, the less amblyopia from nonuse. Thelonger the eye remains crossed, the more complete is the suppression of the image of the deviating eye, and the more difficult it becomes to reawaken the diplopia, and, finally to create a demand for fusion of the two images. Once the desire for fusion is well developed, if the eyes are set relatively straight, that desire will finish our work. Instead of having exercise of the fusion ten to twenty-five minutes at a time for two or three times a week, they naturally exercise that faculty every minute during the waking hours, and nothing short of a paralysis of an ocular muscle will break down this fusion".

This seems a logical procedure to follow. There can be no doubt that many children are saved from monocular vision by such a plan of treatment. It is certain that to wait until the child is twelve or thirteen years of age to operate is simply permitting the loss of vision in the deviating eye. Operation at this time can only bring about a cosmetic result.

A. E. Davis says: "I believe it a good plan to operate as sonn as the angle of squint ceases to improve with orthoptic measures. Nothing is to be gained by waiting, whilemuch is to be lost. After surgical interference setting the eyes straight exercises can be used to

great advantage, often resulting in a complete cure.[1]

"Age: rarely operate under two years of age. Orthoptic exercises suffice up to the age of three, then stereoscopic exercises for fusion training is followed by operation, if necessary. In constant unilateral squint that does not improve, and is accompanied by false fixation, operation should be done at two years or earlier".

Linn Emerson gives his view in the following quotation: "While there is no doubt that at least ninety per cent of such patients could, theoretically, be cured by non-surgical methods, as a matter of fact, less than fifty per cent can practically be cured, because of unfavorable circumstances. Owing to neglect or bad advice at least half of them do not come under observation until they are more than four years old. In our various hospitals and clinics, few men have the time or inclination to give them intensive treatment. Cooperation of the parents, often due to lack of adequate means, is frequently half-hearted or entirely absent. I am, therefore, now limiting the use of this plan of treatment (Worth's non-operative treatment) to patients seen early and where satisfactory cooperation can be secured".

Emerson advocates the combination of the operative with the orthoptic plan of treatment. He was impressed with results obtained from orthoptic treatment following an operation which only partially corrected a squint. Finding that complete correction of deviation by operation was unnecessary, it occurred to him that simpler operations could be performed and followed by orthoptic treatment with excellent

results. So Emerson does many recession operations and tendon tuckings on small children and follows these operations with continued orthoptic treatment.

Another powerful argument for early operation and cure of squint is to enable the child to omit the wearing of glasses. Under the old system of squint therapy strong glasses were prescribed and kept on until the child reached physical maturity. In consequence this individual was condemned to wear glasses for the remainder of life. After wearing strong glasses of hypermetropic correction during childhood and adolescence the accomodation is weakened and the individual cannot see with comfort or distinction for distance or near without glasses.

CHAPTER V

AMBLYOPIA

Amblyopia is a reduction in the acuteness of vision which cannot be relieved by glasses and which is not dependent upon any visible changes in the eye. This condition may be either congenital or acquired.

Congenitally defective vision confines itself to one eye and almost invariably is associated with high degrees of hyperopia and astigmatism. Probably, in many of the so-called congenital cases, the amblyopia is really acquired. Worth tells us that congenital amblyopia up to 6/12 is uncommon, between 6/18 and 6/60 it is rate and its origin is open to doubt. He has never seen congenital amblyopia of higher degree than 6/60. Worth gives the characteristics of congenital amblyopia as follows: "The fundus and media are normal in appearance. The fields of vision, both for white and colors, are full. There is no scotoma. Central color perception is normal. The peripheral form vision up to within twenty degrees of the fixation point is normal. So that the defect would seem to consist in a want of due preponderance of the macular region, and not in a general lowering of the sensibility of the visual apparatus".

Amblyopia ex Anopsia may result from any interference with vision, either congenital or dating from early life, which prevents perfect focusing upon the retina. In the case of squint this condition is met with by the deviating eye. The constant deviation of this eye

results in a gradual deterioratinn of the visual acuity. The younger the child the more rapid this deterioration from disuse takes place. In constant unilateral squint beginning at the age of 6 ro 8 months, the power of central fixation of the squinting eye is often lost in eight or ten weeks; with the onset of squint at the age of about 18 months, central fixation is usually not lost for five or six months; with the onset of squint at the age of three years, central fixation is not lost for a year; when the onset of squint is as late as six years or older, rarely does loss of central fixation occur. Again we quote Worth as follows: "Amblyopia ex anopsia, like congenital amblyopia, concerns almost entirely the central and paracentral regions of the retina and produces no contraction of the peripheral limits of the field of vision. But the blindness often reaches an extreme degree which is never met with in the congenital form....."

As has been previously stated, in congenital amblyopia the central vision is never lower than 6/60. In an extreme case of acquired blindness there is often a scotoma extending 15° to 20° round the center of the visual field. Within this scotoma vision may be reduced to light perception, while outside of this area fingers may be counted at a foot or two from the face.

CHAPTER VI

STATISTICS ON SQUINT

The data given below has been obtained partly from Worth's "Monograph on Squint" and partly from one hundred nineteen case records at the Wisconsin General Hospital.

During the years of 1901 and 1902, 10,239 school children were examined in the Maryletone and Tower Hamlets districts of London, England. 253 or 2.5% were found to have constant squint. In 231 or 91% of these 253 cases the squint was of the convergent type and in 22 or 9% of the cases the squint was of the divergent type.

The 119 cases reviewed at the Wisconsin General Hospital arrange themselves as follows:

Monocular convergent squint	70
Alternating convergent squint	37
Divergent squint	10
Paralytic convergent squint	2
	119

Excluding the two cases of paralytic squint 91.5% of the cases were of the convergent type and 8.5% were of the divergent type. Among the 119 cases reviewed strabismus was found to be distributed rather evenly between the two sex. 48% of the cases were males and 52% were females.

Age of Onset.

Worth presents the following data on thenumber of cases of

monocular convergent squint beginning in each year of life:

Before 1 year.....134 cases
Between 1 and 2 years.....186 "
Between 2 and 3 years.....247 "
Between 3 and 4 years.....189 "
Between 4 and 5 years.....113 "
Between 5 and 6 years..... 73 "
After 6 years..... 75 "

Nearly 75% of the cases appeared before the end of the fourth year and in less than 7.5% of the cases deviation did not occur until after the sixth year.

Data on cases of alternating convergent squint (Worth).

Before 1 year..... 61 cases
Between 1 and 2 years..... 34 "
Between 2 and 3 years..... 23 "
Between 3 and 4 years..... 29 "
Between 4 and 5 years..... 11 "
Between 5 and 6 years..... 6 "
After 6 years..... 14 "

In more than 53% of the above cases of alternating convergent squint deviation was seen before the end of the second year. This high proportion, according to Worth, is due to the fact that the essentially alternating squints appear in early infancy.

Myopic divergent squint, according to Worth, usually makes its appearance when the child is 10 or 12 years of age. Another type of divergent squint, the neuropathic divergent squint, usually begins during infancy.

Before presenting further data collected from cases reviewed at the Wisconsin General Hospital, it should be mentioned here that in many cases the records were not complete or were vague and indefinite terms were used. Therefore, complete records on the total 119 cases cannot be given here. It is hoped, however, that what is to follow will prove to be of some value.

Age of Onset in cases of Monocular Convergent Squint.

Before age of four years.....57 cases

After age of six years..... 5 "

Alternating convergent squint.

Before two years..... 14 cases

Between two and three years..... 4 "

After three yearx..... 2 "

It will be noticed that the trend of the above figures is to agree with those presented by Worth.

The age of the patient when first admitted to Wis. Gen. Hosp. for treatment of squint.

	Number of Cases	Percentage of Total
Under 4 years	5	4%
5 to 6 years, inclusive	16	13%
7 to 8 years, inclusive	16	13%
9 to 11 years, inclusive	28	26%
12 to 15 years, inclusive	15	12%
15 to 20 years, inclusive	17	14%
After 20 years	20	16%

Seventy per cent of patients entering the hospital for treatment of squint for the first time were above the age of 8 years.

Visual Acuity of Squint Cases entering Wisconsin General Hospital.

Among those cases in which visual acuity had been recorded there were 37 cases of monocular convergent squint, 7 cases of alternating convergent squint and 2 cases of divergent squint, in which the vision of at least one eye was below 20/50. In a number of these cases vision in one eye had been reduced to counting the fingers one or two feet from the face. Cases which showed definite pathology in the fundus have not been included here. Three cases of bilateral congenital cataract have also been excluded. No attempt has been made to separate possible cases of congenital amblyopia from the above group. Of the above cases which showed vision of 20/50 or less in one eye only six had received (according to records) previous treatment. In each case treatment had been in the form of optical correction.

Type of Treatment received by patients entering Wis. Gen. Hospital.

As would be expected from the description of the type and age of patient received at Wisconsin General Hospital, the treatment was largely surgical.

On fifty-seven cases of convergent squint a Reese resection and either partial or total (nearly always partial) tenotomy was performed. In eight cases of convergent squint a Reese resection alone sufficed. Partial tenotomy was used alone in two cases.

For divergent squint a total tenotomy was the favorite operation in all 7 cases where surgical treatment was given.

Of all cases entering hospital fifteen cases received optical correction alone. For the remaining cases no record of any treatment given could be found.

CHAPTER VII

ECONOMIC VALUE OF SQUINT THERAPY

The effect of squint in later life is monocular sight with greatly reduced vision in the squinting eye. The visual elements have not been developed and consequently amblyopia is marked. The result is the same practically as a one-eyed person with deficient perception of depth and absence of stereoscopic vision. We find many cases in which vision in the squinting eye is reduced to 20/200. In the extreme cases of acquired blindness there is often a scotoma extending 15 to 20 degrees round the center of field vision. In this scotoma there may be bare perception of light. Outside of this area fingers may be counted a foot or two from the face. From a practical standppint an individual with 20/200 vision has an economically blind eye. Wurdemann states that the loss of one eyeball is rated at from $600 to $2,880. from fifty weeks to two hundred, or life annuity, from 27½ to 66 2/3 per cent, averaging about $2000.00 The loss of sight in one eye without the loss of the globe is generally less. Wurdemann, however, refers to many cases in which individuals were recompensed to the extent of from $3,000 to $16,333. for the loss of sight in one eye. Von R. Hessberg of Germany has estimated that loss of vision in one eye reduces an individual's earning capacity by 25%. For such an injury a man is compensated to the extent of 25% of his original earning capacity. We may say that "sight is priceless" and "vision is not a commodity that may be purchased or disposed of in the market". Nevertheless in dealing with the subject strictly from the standpoint of an individual's earning capacity, we must admit the established economic fact that in-

jury to vision of more than a certain degree necessitates limitation in the amount and character of work. Following upon this it is easily deducible that the amount of wages received would be less.

But it is obviously impossible to estimate the total value of binocular vision in mere dollars and cents. The loss of vision in one eye halves the reserve fund. Consider an individual's position if his remaining good eye should be lost, through accident or disease. There is certainly some psychical effect, some dread of losing the vision of the fellow eye. We cannot calculate what is in the minds of men. We cannot measure what it means to an individual to be unable to fulfill some secret ambition because of his poor eyesight. Personalities differ and with these varying personalities come varying reactions. But although the visual incapacity resulting from loss of vision in one eye has been variously estimated from fifteen per cent to fifty per cent we must not overestimate the handicap so provided to the individual. Hannibal and Philip of Macedon each had but one eye and it is a well known fact that Theodore Roosevelt was blind in one eye after being struck in a boxing match. So it is apparent that the one eyed individual's outlook is far from hopeless.

The cosmetic effect of squint must be appreciated, and often, for this reason operation is undertaken, although in later years improvement of vision and binocular fixation are not apt to result even after operation which corrects the deviation in the squinting eye. Data concerning a relative number of cases of squint corrected by surgical methods for cosmetic effect only compared with those corrected for pur-

pose of saving eyesight in deviating eye could not be obtained. I believe it is reasonable to estimate, however, that 75% of squint surgery done at present time is done purely for cosmetic effect.

The psychological effect of this most obvious deformity as well as the effect of the deformity on the interrelationship of the individual and society must not be underestimated. In this connection let us read what E. H. Hallock has to say: "In the animal kingdon, any individual who varies markedly from the pattern of his fellows is an object of abuse, derision and persecution. This is no less true in the human family; and often more so during childhood. A child who is different in body from his fellows may serious psychological harm, in addition to his physical abnormality. His whole adult life may be adversely affected. Among such abnormalities, and impossible to conceal, is the condition of squint or strabismus".

W. W. Lewis has the following to add: "If every practicing physician and graduate nurse would feel his individual responsibility in directing and advising insistently the parents of cross-eyed infants to seek immediate relief at the hands of competent ophthalmologists, the economic fortune to humanity would be incalculable, not to mention the happiness of the parents and the grown-up subjects. And who knows but that we may have a possible Oliver Cromwell, or Florence Nightingale standing before us, whose fate may be in our hands, and at the parting of the ways, and approaching the fork in the road of life, either to develop into a leader of his fellows or to be stunted by the development of an inferiority complex within him".

Finnoff concludes a paper on squint with the following words: "A crossed eye in an impressionable child is a serious handicap to the normal development of mentality and his reaction to everyday life. He soon learns that he is different from others and early becomes a subject of ridicule. In a sensitive child this develops an inferiority complex that in many cases lasts throughout life. It is a factor that seems to have been overlooked by many ophthalmologists as well as others. This is often of greater importance in the child's future happiness than the physical comfort gained by the approximation of the visual axis".

Everyone will agree that squint is a disfiguring deformity and one that cannot be concealed. How much this defect detracts from personal appearance varies with the degree of deviation and with the type of squint. There are a few people who still believe that squint is a "curse" and that to see a cross-eyed person is an omen of ill-fortune. While these beliefs are products of ignorance and superstition the harm they do is none the less brought to bear on the unfortunate squinter.

In a large number of individuals the disfiguring quality of their deformity is grossly over-estimated. This tendency to magnify often results in a shut-in personality, seclusiveness, and inferiority complex which when once formed is extremely difficult if at all possible to eradicate. If we waive the psychic effect and consider only the physical defect we still have an immensely important problem with

which to deal. To a young woman or young man presenting himself to the business or social world, personal appearance is a significant factor. An otherwise gifted young man or woman will often find himself at a serious disadvantage when competing with normal individuals Squint surgery can do much for such individuals. An accurate operation by a competent ophthalmologist will correct the deviation. While we may not be able to give back to an individual sight in the squinting, we may make him a happier and better citizen because of correcting his deformity.

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